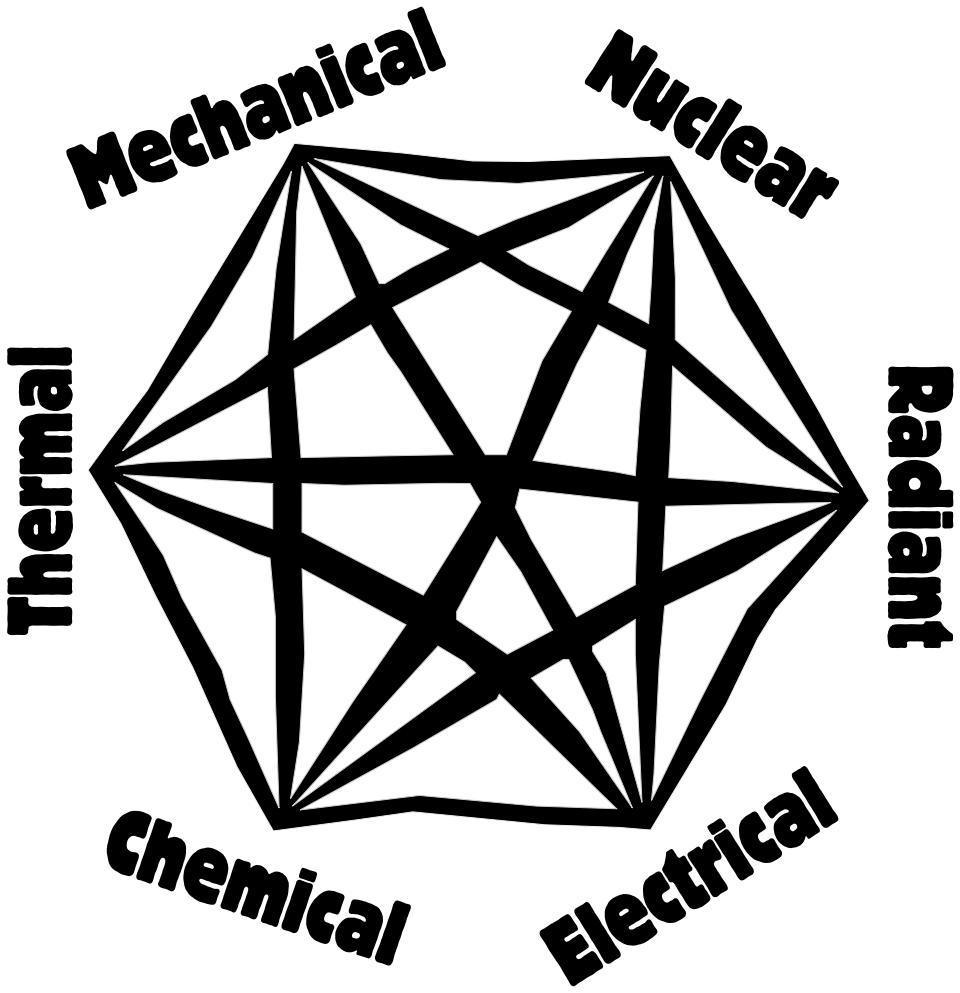
What is Energy?

Two basic concepts are important in understanding the sources of energy:

1. **Energy is the ability or capacity to do work.**

2. **Energy cannot be created or destroyed.**

Fig. 1-1-4 Energy transfer in a pendulum, p. 56



Any of these forms of energy can be changed into any of the other forms.

Fig. 1-1-5 Any of these forms of energy..., p. 57 **OH-3**

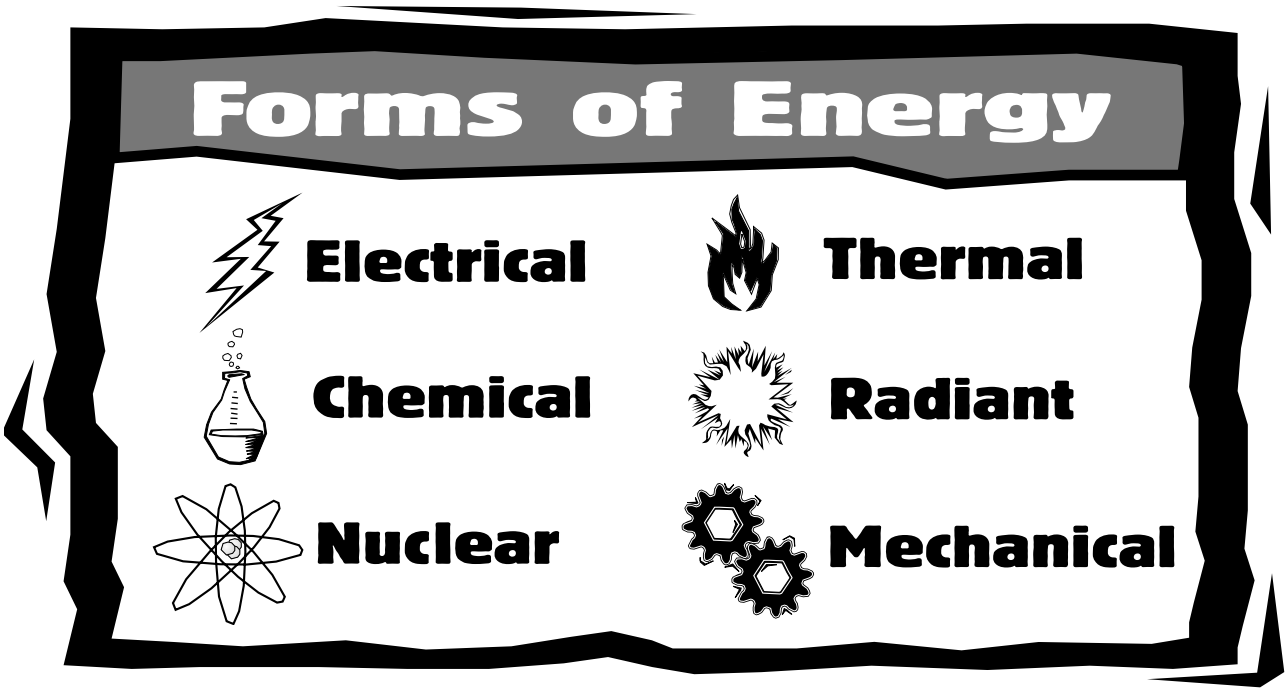


Fig. 1-1-6 Forms of energy, p. 57

Transportation

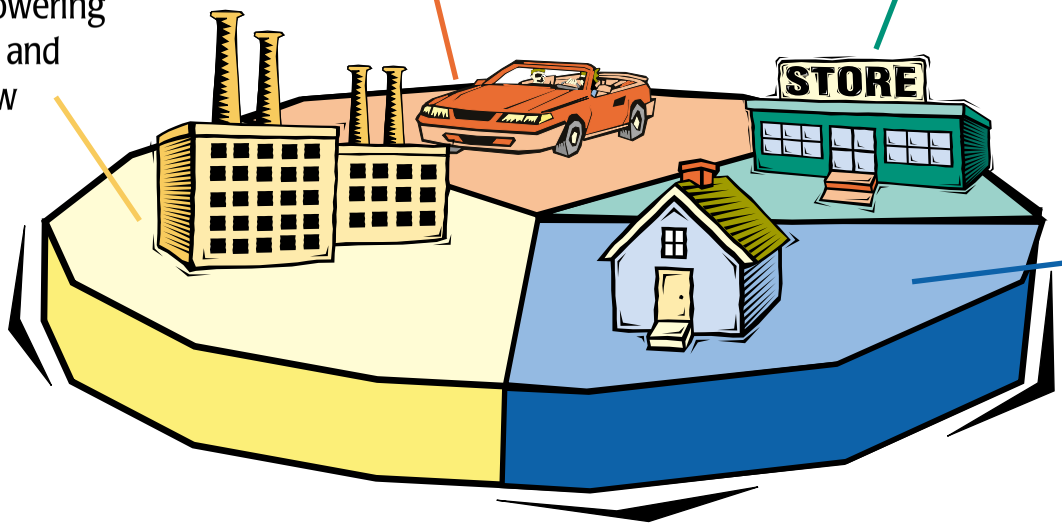
27 percent is used to move people and goods in automobiles, trucks, trains, airplanes, and ships.

Industrial

36 percent of all the energy we control is used in industry, including heating furnaces, powering production lines, and processing raw materials.

Commercial

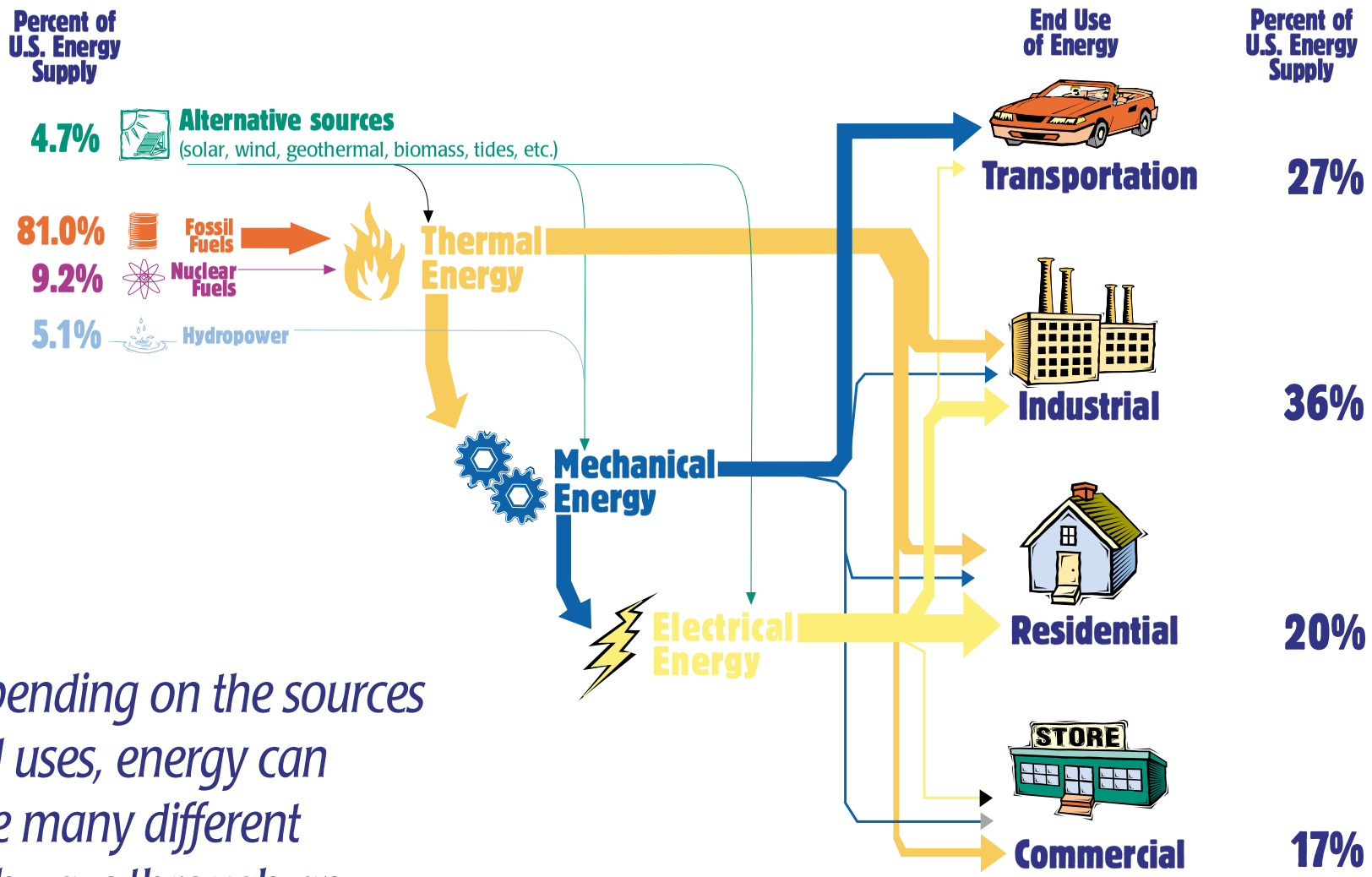
17 percent is used for businesses' heat, light, and office machines, including computers.



Residential

20 percent is used in our homes to provide heat and light and to power the machines and equipment used there.

Fig. 1-1-10 U.S. energy consumption, p. 62

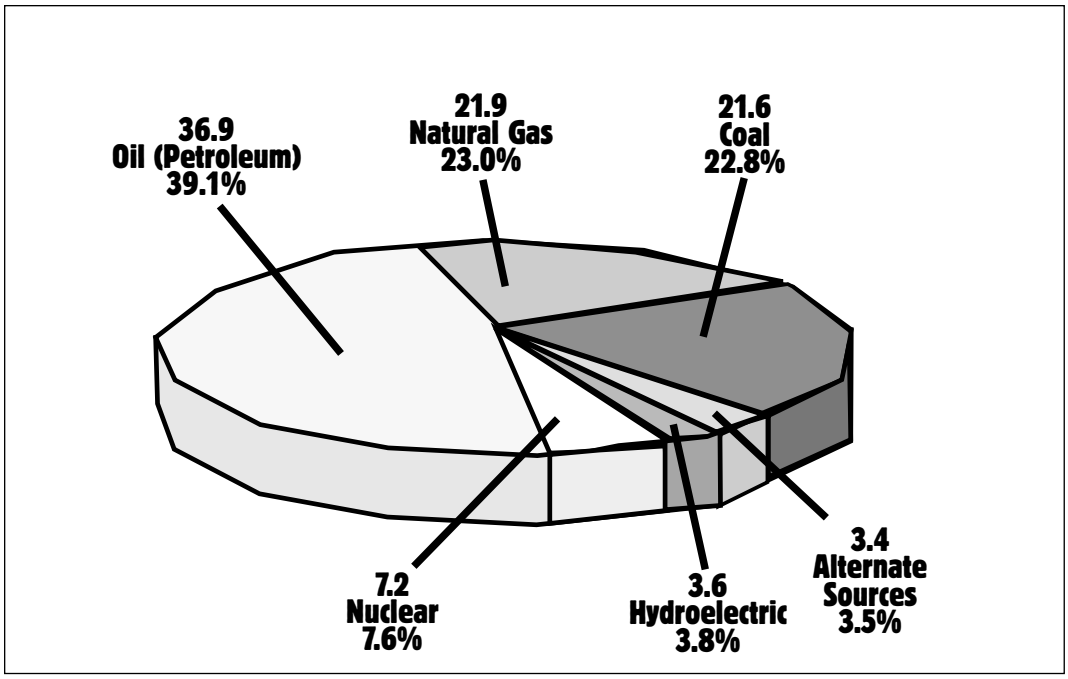


Depending on the sources and uses, energy can take many different pathways through an energy control system.

Fig. 1-1-11 Depending on the sources..., p. 63

U.S. Consumption of Fuels, 1998

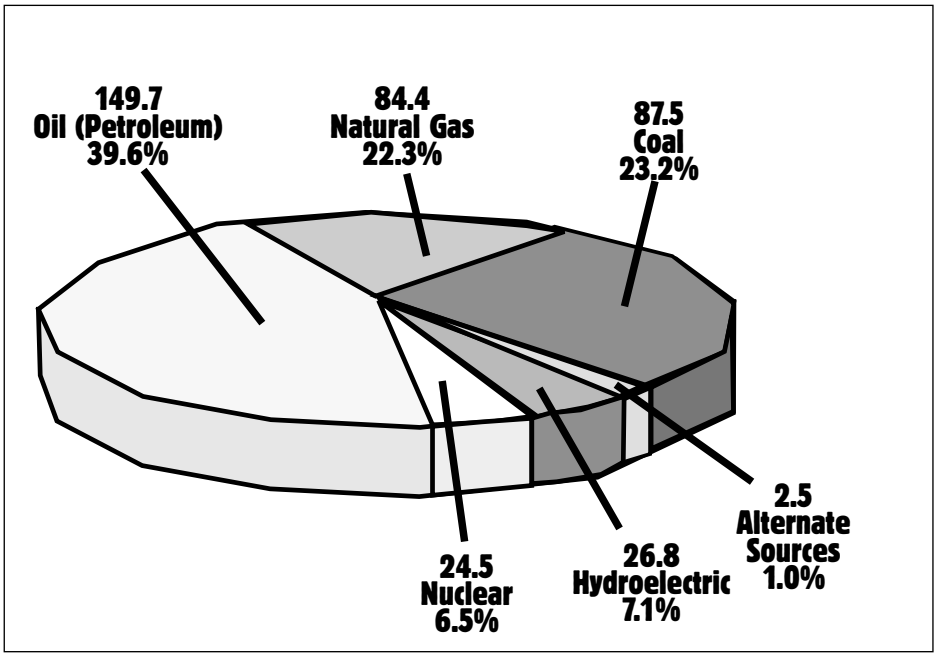
(Quadrillion Btu)



Source: U.S. Department of Energy

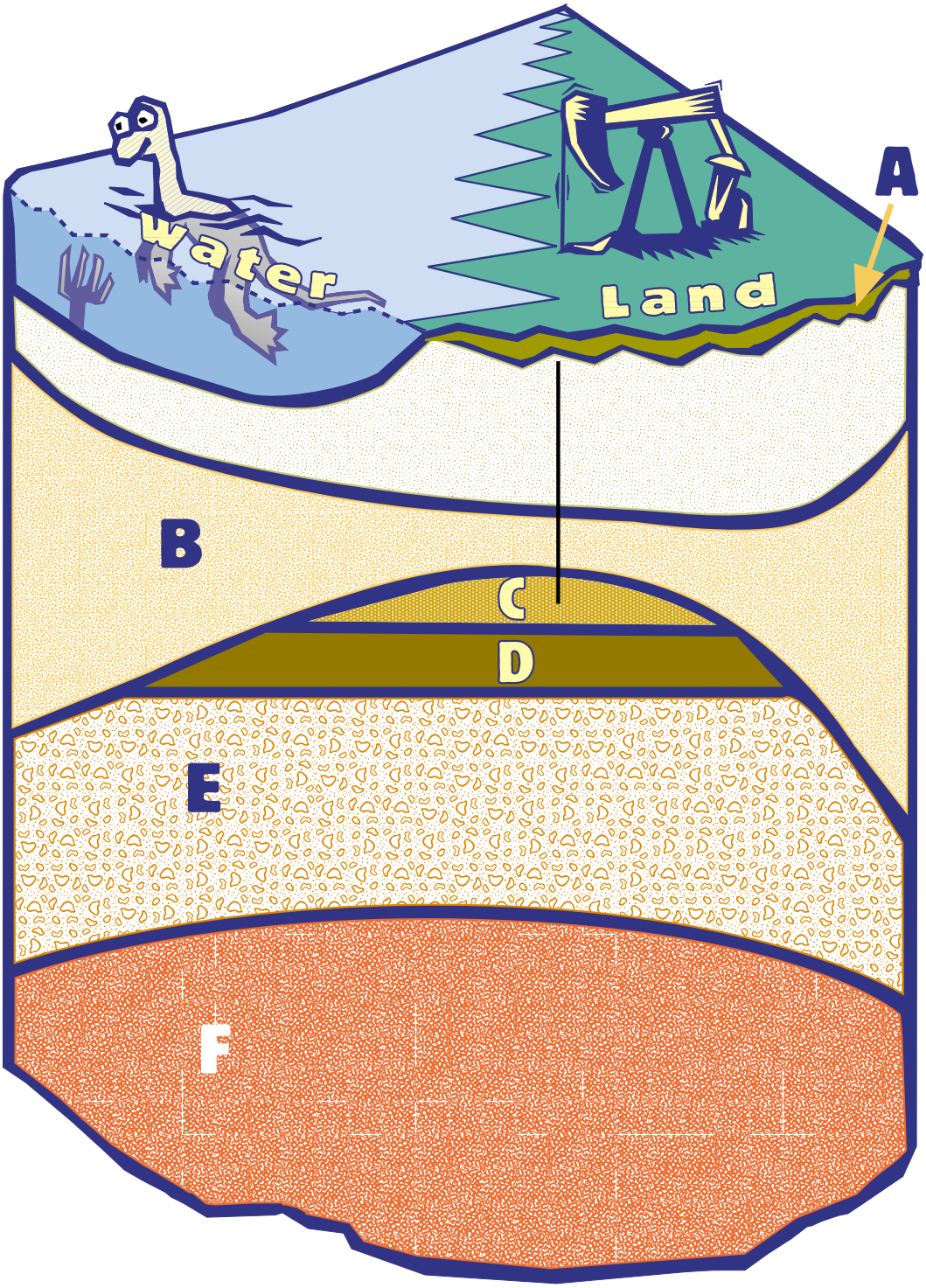
World Consumption of Fuels, 1998

(Quadrillion Btu)



Source: U.S. Department of Energy

Fig. 1-2-1 U.S. and world consumption of fuels, p. 78



A. Soil B. Impermeable rock or shale C. Natural gas in sandstone D. Oil in sandstone E. Water in sandstone F. Impermeable rock

*The most useful gas and oil lie trapped within **porous** networks of rocks buried thousands of feet below the earth's surface.*

Fig. 1-2-3 The origins of oil and gas p. 80

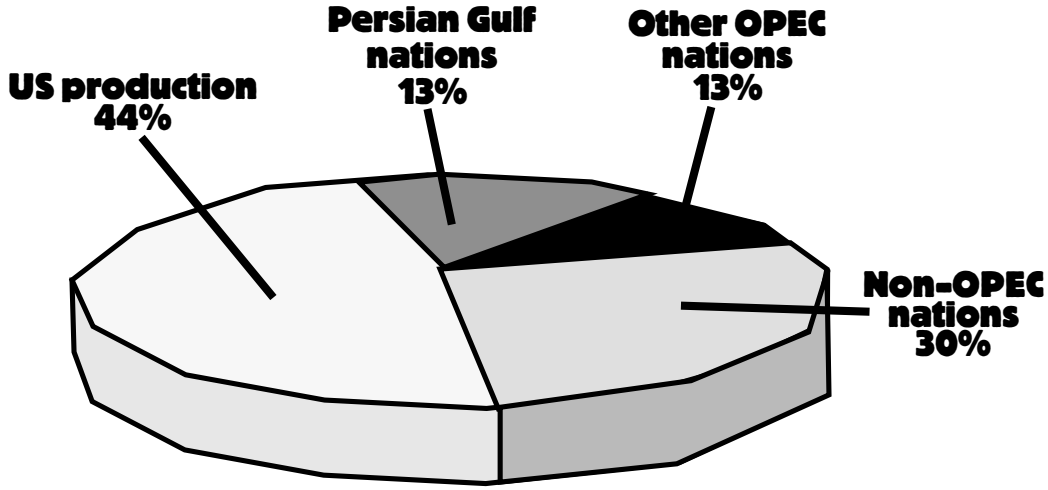


Figure 1-2-5 Sources of U.S. petroleum, 1999
Source: U.S. Department of Energy

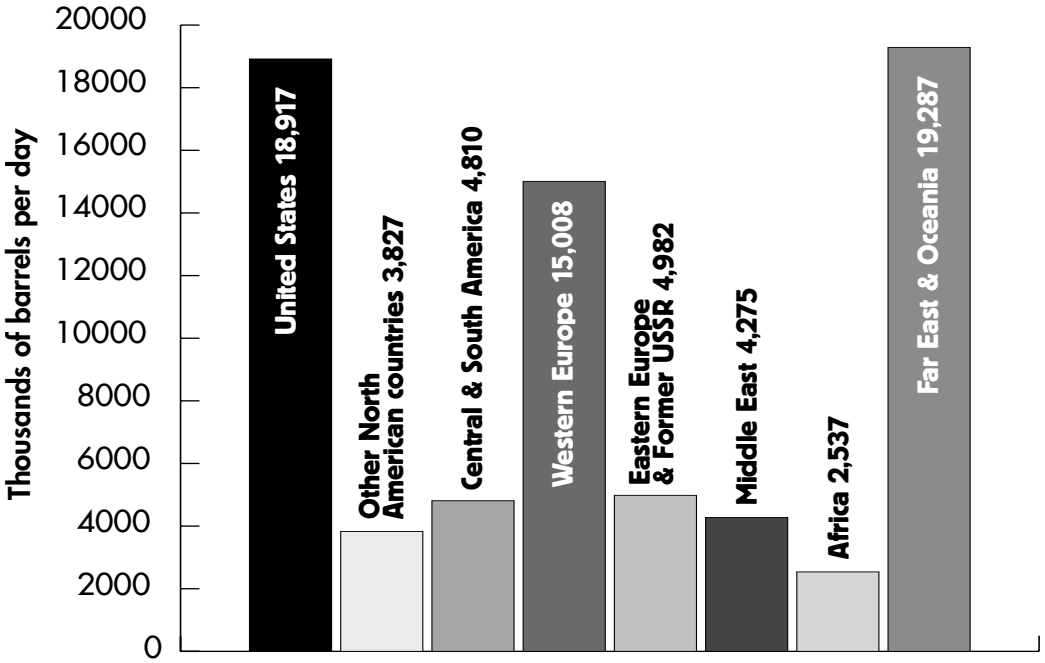


Figure 1-2-6 World petroleum consumption
Source: U.S. Department of Energy

Fig. 1-2-6 Sources of U.S. petroleum and world petroleum consumption p. 82 OH-9

Fig, 1-2-7 Processing of raw natural gas, p. 85 **OH-10**

Source: Koch Industries

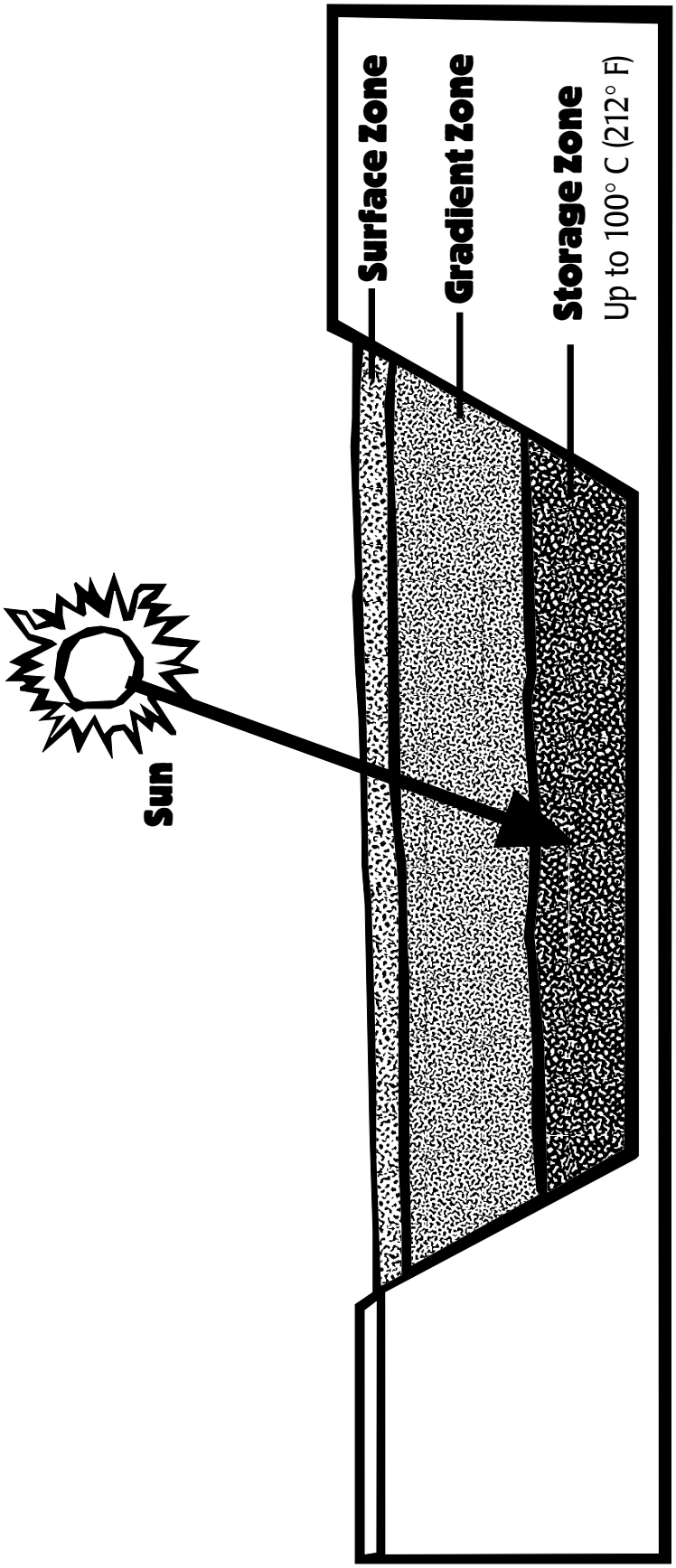
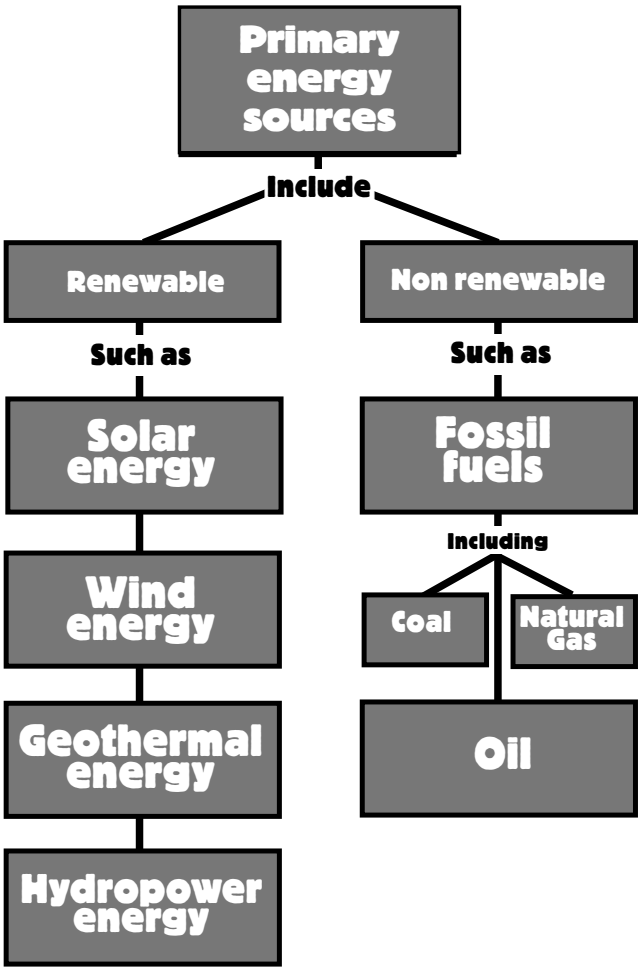


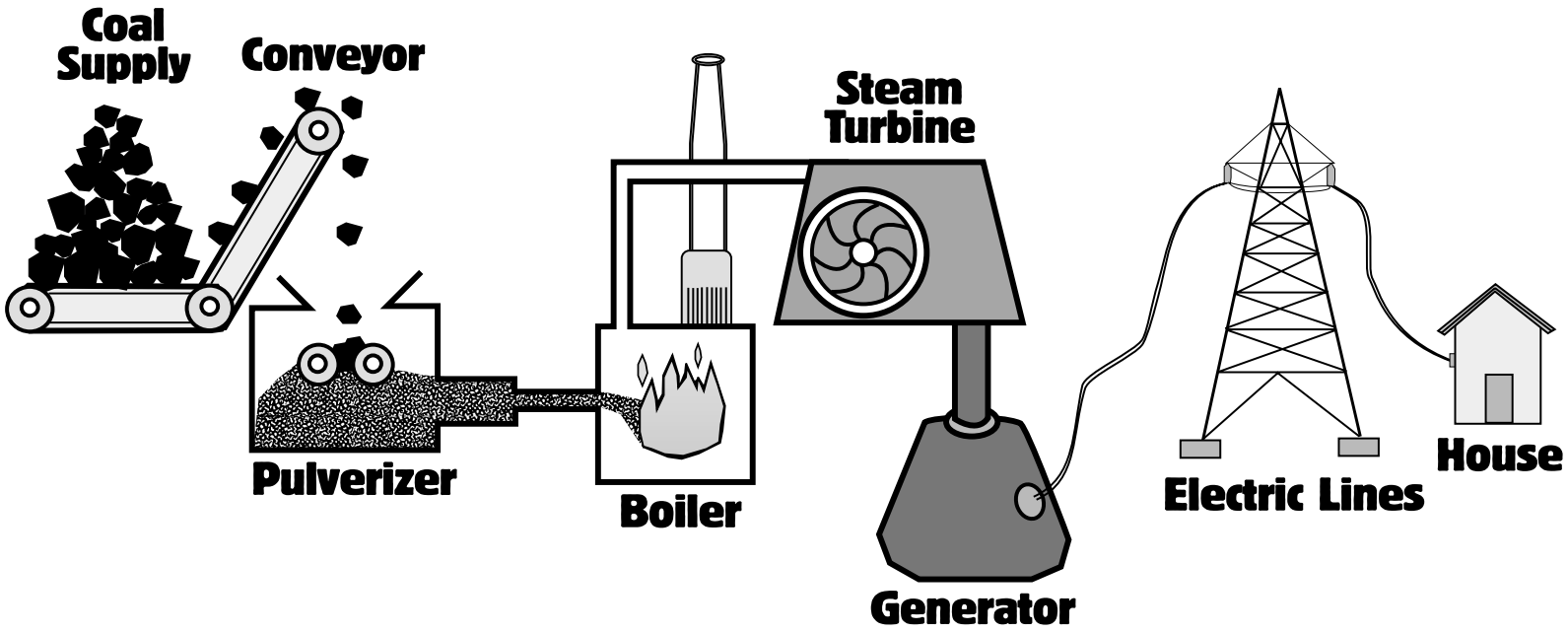
Figure 1-3-10
Layers of a solar pond

Fig. 1-3-10 Layers of a solar pond, p. 104



Secondary energy sources are products of human technology generated from primary energy sources. The most common secondary energy source is **electricity**.

Form of Energy	Primary Energy Source	Transformation to Secondary Energy Source
mechanical	wind	windmill turns an electricity-generating turbine
chemical	peat	burns to heat water to make steam to turn a turbine
thermal	geothermal heat	well brings superheated water to surface to turn turbine
light	sunlight	photovoltaic cells generate current
nuclear	fission	reactor heats water into steam to turn turbines



The coal is ground to a powder for more efficient combustion before it is burned to heat a boiler. The resulting steam is under pressure, so when released it has enough force to turn a turbine. The rotating turbine powers a generator. In the generator, magnets spin inside a wire coil to produce electricity. The current is then transmitted through wires to users.

Flg. 1-3-13 Steps in coal-powered electricity production, p. 109